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(71) Applicant: **Meritor Heavy Vehicle Technology LLC**  
**Troy, Michigan 48084 (US)**

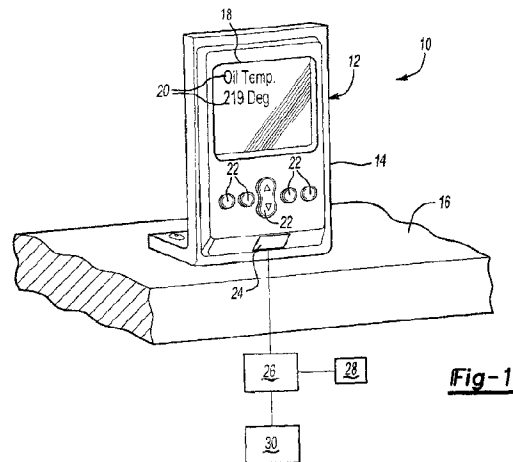
(72) Inventors:  
 • **Chene, George**  
**Sterling Heights, Michigan 48314 (US)**  
 • **Shintaku, Wayne**  
**Auburn Hills, Michigan 48326 (US)**

• **Worrall, Jack R.**  
**Novi, Michigan 48375 (US)**  
 • **French, Lee A.**  
**Sterling Heights, Michigan 48310 (US)**  
 • **Ramsey, Reno V.**  
**Lake Orion, Michigan 48359 (US)**  
 • **Mueller, Brian Jeffrey**  
**Sarasota, Florida 34240 (US)**  
 • **Kramer, Dennis A.**  
**Troy, Michigan 48098 (US)**

(74) Representative: **Jones, John Bryn et al**  
**Withers & Rogers,**  
**Goldings House,**  
**2 Hays Lane**  
**London SE1 2HW (GB)**

(54) **Vehicle data display device and method for data display**

(57) A vehicle data display device (10) is provided that includes a screen (18) with characters (20) displayed thereon. The characters have display attributes such as font size, line spacing, brightness, contrast, and location of the character on the screen (18) all of which contribute to making the characters (20) readable to the vehicle occupant. A vehicle environment sensor (28) is used to detect a vehicle environment condition and produce a signal in response thereto. A control device (26) adjusts the display attributes of the characters on the screen (18) in response to the signal to improve the readability of the characters (20). For example, a light sensor may be used to detect the light condition in the area of the screen. The brightness and contrast may be adjusted accordingly to provide maximum readability to the characters to the occupant. Additionally, the font size and line spacing between characters may be increased as the vehicle speed increases so while the vehicle is in motion the characters are easier to read. Furthermore, a motion detection device (28) such as an accelerometer may be used to detect vibration of the screen to change the location of the characters and stabilize the image displayed on the screen.



**Fig-1**

## Description

### BACKGROUND OF THE INVENTION

[0001] This invention relates to a vehicle data display device, more particularly, the invention relates to a method and apparatus for improving the readability of the characters on the screen of the display device during operation.

[0002] Display devices such as speedometers and clock radios are commonly used in vehicles to convey vehicle information to the occupant. The display devices are typically analog or digital and are integrated into the vehicle during initial vehicle design. As a result, during changing vehicle environment conditions such as vibration of the vehicle due to bumpy roads, low or bright light, and/or rapid movement of the vehicles, the vehicle occupant is able to read the display device. In the case of personal computers, which are often used in vehicles, the display device is not integrated into the vehicle and therefore the characters on the screen of the display device are difficult to read. In particular, handheld personal digital assistants (PDA) are becoming more widely used. Because of the portability of PDAs, such as Palm Pilot® and Hand Spring® devices, it is desirable to utilize PDAs in vehicles such as commercial trucks to display additional vehicle data and provide flexibility and customization of information for commercial trucks. Since PDAs are not designed for such applications, the characters displayed on the screen are often not readable to the occupant due to changing vehicle environment conditions. Any adjustments that the occupant is able to make to the PDA manually detracts the occupant's attention from operation of the vehicle. Therefore, what is needed is a PDA for use in vehicles such as commercial trucks which improves the readability of the characters displayed on the screen to permit the occupant to focus his attention on operation of the vehicle.

### SUMMARY OF THE INVENTION AND ADVANTAGES

[0003] The present invention provides a vehicle data display device that includes a screen with characters displayed thereon. The characters have display attributes such as font size, line spacing, brightness, contrast, and location of the character on the screen all of which contribute to making the characters readable to the vehicle occupant. A vehicle environment sensor is used to detect a vehicle environment condition and produce a signal in response thereto. A control device adjusts the display attributes of the characters on the screen in response to the signal to improve the readability of the characters. For example, a light sensor may be used to detect the light condition in the area of the screen. The brightness and contrast may be adjusted accordingly to provide maximum readability to the characters to the occupant. Additionally, the font size and line spacing between characters may be increased as

the vehicle speed increases so while the vehicle is in motion the characters are easier to read. Furthermore, a motion detection device such as an accelerometer may be used to detect vibration of the screen to change the location of the characters and stabilize the image displayed on the screen.

[0004] Accordingly, the above invention provides a vehicle data display device but improves the readability of characters on a screen.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Other advantages of the present invention can be understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a schematic view of the present invention utilizing a PDA;

Figure 2 is character display attributes when the vehicle is moving at a low speed; and

Figure 3 is the display attributes of the characters when the vehicle is moving at a higher speed.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0006] A vehicle data display device 10 is schematically shown in Figure 1. The vehicle data display device 10 includes a personal computer 12 such as a PDA. The PDA may be a Palm Pilot® or Hand Spring® device or any other suitable computer and display device. The PDA 12 may be received by a mounting member 14, which is preferably a cradle. The cradle 14 has a databus (not shown) which receives the device databus 24. The PDA 12 has a screen 18 for displaying characters 20. The screen 18 may be a touch screen for receiving inputs from a stylus. Input keys 22 may also be used to enter data into the PDA 12. The mounting member 14 may be secured to a portion of the vehicle 16 such as a dashboard.

[0007] The device databus 24 is connected to a control device 26, which may be hardware or software. The control device 26 may be incorporated into the PDA 12 or the cradle 14. Alternatively, the control device may be located on a portion of the vehicle or integrated into the vehicle controller 30. A vehicle environment sensor 28 is electrically connected to the control device 26 for sensing a vehicle environment condition. Vehicle environment sensor, may alternatively be connected to the vehicle controller 30.

[0008] Since the PDA 12 is separately mounted to the vehicle and not designed to be integrated into the vehicle, the PDA 12 and its screen 18 are subject to vibrations during vehicle operation. The more severe the vibrations become the more difficult it is to read the characters 20 displayed on the screen 18. This may distract the vehicle occupant from operating the vehicle. To im-

prove the readability of the characters 20 on the screen 18, the vehicle environment sensor 28 may be a motion detection device such as an accelerometer, which detects the vibration to which the screen 18 is subjected. The accelerometer may be arranged in a vertical direction to detect vibration in the vertical direction. The signal from the accelerometer may be received by the control device 26. The control device 26 sends a signal to the PDA 12 to adjust the location of the characters. That is, if the characters 20 appear to be moving vertically on the screen 18 due to vibration, the control device 26 will adjust the characters 20 accordingly so they appear to remain stable. Said another way, the accelerometer and control device 26 cooperate to minimize the effects of vibration on the screen 18.

**[0009]** In another embodiment of the present invention, the vehicle environment sensor 28 may be a photosensor for detecting the light condition in the area of the screen 18. In bright light conditions the characters 20 on the screen 18 may appear to be washed out. The control device 26 may adjust the contrast or brightness of the characters 20 on the screen 18 in response to the signal from the photosensor to improve the readability of the characters 20. In low light conditions the contrast or brightness may be adjusted by activating a back light in the screen 18 of the PDA 12.

**[0010]** In yet another embodiment of the present invention, the characters 20 may have a particular font size and line spacing as shown in Figures 2 and 3. When the vehicles at rest or traveling at low speeds, the font size and line spacing at which the characters 20 are typically displayed on the screen 18 are acceptable. However, when the vehicle is traveling at greater speeds it is more difficult for the occupant to read the characters 20 at the font size and line spacing typically used. Accordingly, the vehicle environment sensor 28 may include a speedometer signal which provides the vehicle speed. The vehicle speed may be provided by a separate sensor or a signal from the vehicle controller 30. The font size and line spacing of the characters 20 may be increased, as shown in Figure 3, to improve the readability of the characters 20 to the vehicle occupant. In this manner, the vehicle occupant need not attempt to adjust the characters 20 to improve readability during vehicle operation. Since less data may be displayed on the screen 18, the screen 18 may include scrolling indicia that may be easily manipulated by the vehicle occupant by manipulating the touch screen or input keys 22.

**[0011]** The invention has been described in an illustrative manner, and it is to be understood that the terminology that has been used is intended to be in the nature of words of description rather than of limitation. Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

## Claims

### 1. A vehicle data display device (10) comprising:

a mounting member (14);  
a screen (18) attached to said mounting member with characters (20) displayed thereon at a location;  
a motion detection device (26) in communication with said screen to detect a screen vibration and produce a signal in response thereto; and  
a control device adjusting said location of said characters on said screen in response to said signal to improve the readability of said characters.

### 2. The vehicle data display device according to claim 1, wherein said motion detection device is an accelerometer.

### 3. The vehicle data display device according to claim 2, wherein said accelerometer is supported on said mounting member for communication with said screen to detect said screen vibration.

### 4. The vehicle data display device according to any preceding claim, further comprising a portable computer (12) including said screen, and said mounting member comprising a cradle electronically connecting said portable computer and said motion detection device.

### 5. The vehicle data display device according to any one of claims 2 to 4, wherein said accelerometer is arranged to detect said screen vibration in a vertical direction, and said control device adjusts said location of said characters in said vertical direction.

### 6. The vehicle data display device according to any preceding claim, wherein said control device is electrically connected to said motion detection device.

### 7. A vehicle data display device (10) comprising:

a screen (18) with characters (20) displayed thereon having display attributes;  
a vehicle environment sensor (28) detecting a vehicle environment condition and producing a signal in response thereto; and  
a control device (26) adjusting said display attributes of said characters on said screen in response to said signal to improve the readability of said characters.

### 8. The vehicle data display device according to claim 7, wherein said vehicle environment sensor is a light

sensor, and said vehicle environment condition is light, and wherein said display attribute is brightness.

9. The vehicle data display device according to claim 7 or claim 8, wherein said vehicle environment sensor is a light sensor, and said vehicle environment condition is light, and wherein said display attribute is contrast.

10. The vehicle data display device according to claim 7, wherein said vehicle environment sensor is a speedometer, said vehicle environment condition is vehicle speed, and said display attribute is font size, wherein said font size is increased in response to an increase in said vehicle speed.

11. The vehicle data display device according to claim 7 or claim 10, wherein said vehicle environment sensor is a speedometer, said vehicle environment condition is vehicle speed, and said display attribute is line spacing, wherein said line spacing is increased in response to an increase in said vehicle speed.

12. The vehicle data display device according to claim 7, wherein said vehicle environment sensor is an accelerometer, said vehicle environment condition is a vibration of a portion of a vehicle, and said display attribute is location, wherein said location of said characters are adjusted to stabilize said characters on said screen.

13. The vehicle data display device according to any preceding claim, wherein said control device is hardware.

14. The vehicle data display device according to any one of claims 1 to 12, wherein said control device is software.

15. A method of improving the readability of characters on a vehicle data display device (10), the method comprising the steps of:

- a) displaying characters (20) on a screen (18);
- b) sensing a vehicle environment condition;
- c) producing a signal in response to the sensed vehicle environment condition; and
- d) adjusting a display attribute of the characters on the screen in response to the signal.

16. The method according to claim 15, wherein the vehicle environment condition is light, and wherein said display attribute is brightness.

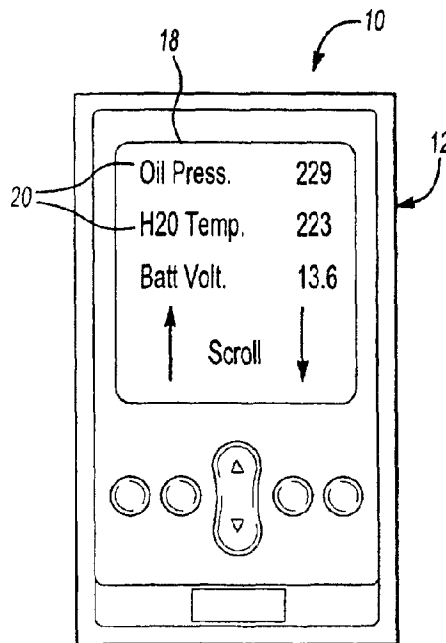
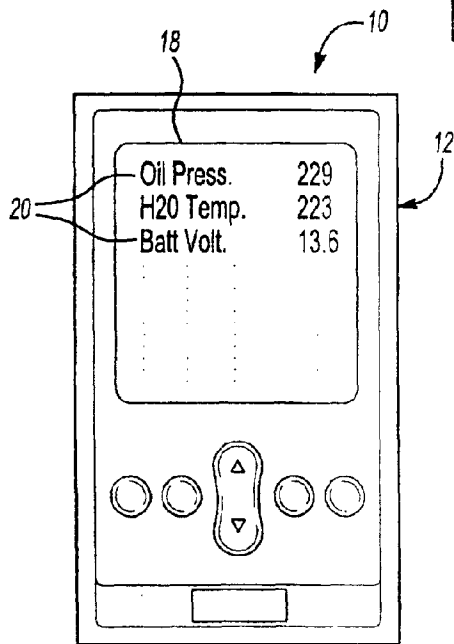
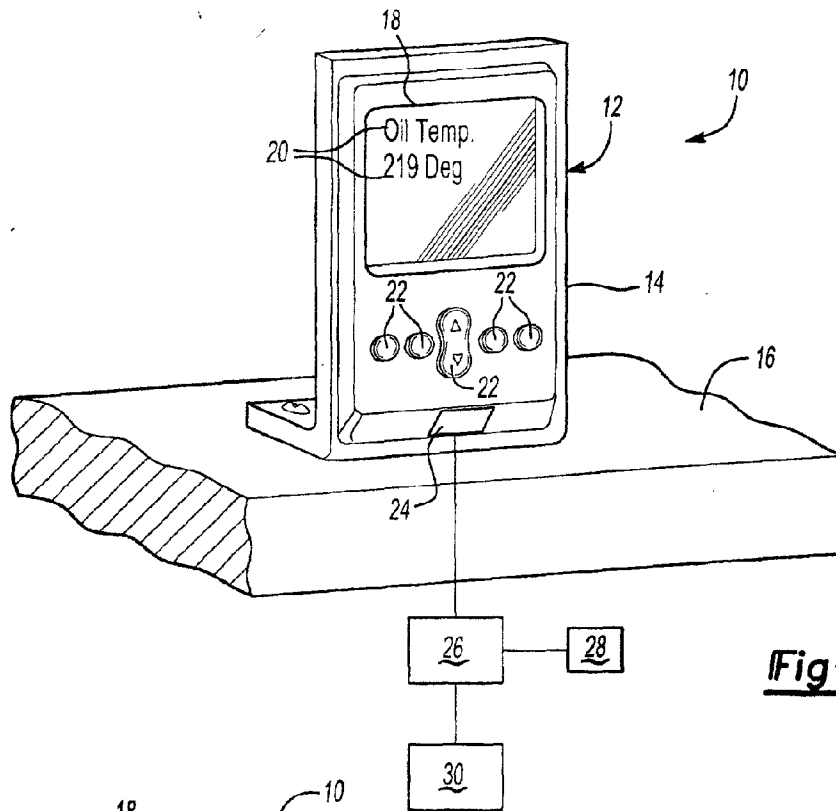
17. The method according to claim 15 or claim 16, wherein the vehicle environment condition is light,

and wherein said display attribute is contrast.

18. The method according to claim 15, wherein the vehicle environment condition is vehicle speed, and the display attribute is font size, wherein the display attribute is adjusted by increasing font size in response to an increase in the vehicle speed.

19. The method according to claim 15 or claim 18, wherein the vehicle environment condition is vehicle speed, and the display attribute is line spacing, wherein the display attribute is adjusted by increasing line spacing in response to an increase in the vehicle speed.

20. The method according to claim 15, wherein the vehicle environment condition is a vibration of a portion of a vehicle, and the display attribute is location, wherein the display attribute is adjusted by changing the location of the characters to stabilize the characters on the screen.





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 01 30 9296

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|  |   |  | TECHNICAL FIELDS SEARCHED (Int.Cl.7)         |
|  |   |  | B60K<br>H04N<br>G09G<br>B60Q                 |
| The present search report has been drawn up for all claims   |   |  |  |
| Place of search<br><b>MUNICH</b>   |   | Date of completion of the search<br><b>29 January 2002</b>   | Examiner<br><b>Plenk, R</b>                  |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |   | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |  |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 01 30 9296

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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